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Millstone Power Station
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MAY 19 2011

U.S. Nuclear Regulatory Commission
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Washington, DC 20555

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DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2
CORE OPERATING LIMITS REPORT, CYCLE 21

In accordance with the Millstone Power Station Unit 2 (MPS2) Technical Specifications (TSs), Section 6.9.1.8.d, Dominion Nuclear Connecticut, Inc., hereby submits, as Enclosure 1, the Cycle 21 Core Operating Limits Report (COLR).

The MPS2 COLR has been revised to incorporate the following:

- Revision to page headers to reflect Cycle 21.
- Addition of a penalty factor to account for the impact of the offset incore instrument (ICI) detectors on the linear heat rate measurement.
- Revision to Figure 2.5-1 based on the analysis supporting the offset ICI detectors.

The COLR has been incorporated into the MPS2 Technical Requirements Manual.

If you have any questions or require additional information, please contact Mr. William D. Bartron at (860) 444-4301.

Sincerely,

R. K. MacManus
Director, Nuclear Station Safety and Licensing - Millstone

Enclosure:

Millstone Power Station Unit 2, Core Operating Limits Report, Cycle 21

A001
MRK

Commitments made in this letter:

None.

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ENCLOSURE

MILLSTONE POWER STATION UNIT 2
CORE OPERATING LIMITS REPORT, CYCLE 21

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2

TECHNICAL REQUIREMENTS MANUAL

APPENDIX 8.1 CORE OPERATING LIMITS REPORT, CYCLE 21

1. CORE OPERATING LIMITS REPORT

This CORE OPERATING LIMITS REPORT for Millstone 2 has been prepared in accordance with the requirements of Technical Specification 6.9.1.8 a through 6.9.1.8 d. The Technical Specifications affected by this report are listed below:

<u>Section</u>	<u>Specification</u>	
2.1	3/4.1.1.1	SHUTDOWN MARGIN – (SDM)
2.3	3/4.1.1.4	Moderator Temperature Coefficient (MTC)
2.4	3/4.1.3.6	Regulating CEA Insertion Limits
2.5	3/4.2.1	Linear Heat Rate
2.6	3/4.2.3	TOTAL UNRODDED INTEGRATED RADIAL PEAKING FACTOR -- F_r^T
2.7	3/4.2.6	DNB Margin

Terms appearing in capitalized type are DEFINED TERMS as defined in Section 1.0 of the Technical Specifications.

2. OPERATING LIMITS

The cycle-specific parameter limits for the specifications listed in Section 1.0 are presented in the following subsections. These limits have been developed using the NRC approved methodologies specified in Section 3.

2.1 SHUTDOWN MARGIN – (SDM) (Specification 3/4.1.1.1)

The SHUTDOWN MARGIN shall be $\geq 3.6\% \Delta K/K$

2.3 Moderator Temperature Coefficient (Specification 3/4.1.1.4)

The moderator temperature coefficient shall be:

- a. Less positive than $0.7 \times 10^{-4} \Delta K/K/^\circ F$ whenever THERMAL POWER is $\leq 70\%$ of RATED THERMAL POWER,
- b. Less positive than $0.4 \times 10^{-4} \Delta K/K/^\circ F$ whenever THERMAL POWER is $> 70\%$ of RATED THERMAL POWER,
- c. Less negative than $-3.2 \times 10^{-4} \Delta K/K/^\circ F$ at RATED THERMAL POWER.

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2.4 Regulating CEA Insertion Limits (Technical Specification 3/4.1.3.6)

The regulating CEA groups shall be limited to the withdrawal sequence and to the insertion limits shown in Figure 2.4-1. CEA insertion between the Long Term Steady State Insertion Limits and the Transient Insertion Limits is restricted to:

- a. ≤ 4 hours per 24 hour interval,
- b. ≤ 5 Effective Full Power Days per 30 Effective Full Power Day interval, and
- c. ≤ 14 Effective Full Power Days per 365 Effective Full Power Day interval.

2.5 Linear Heat Rate (Technical Specification 3/4.2.1)

The linear heat rate, including heat generated in the fuel, clad and moderator, shall not exceed:

- a. 15.1 kw/ft whenever the reactor coolant flow rate (determined per Technical Specification 3/4.2.6.1) is $\geq 360,000$ gpm.
- b. 15.0 kw/ft whenever the reactor coolant flow rate (determined per Technical Specification 3/4.2.6.1) is $< 360,000$ gpm and $\geq 354,600$ gpm.
- c. 14.9 kw/ft whenever the reactor coolant flow rate (determined per Technical Specification 3/4.2.6.1) is $< 354,600$ gpm and $\geq 349,200$ gpm.

During operation with the linear heat rate being monitored by the Excore Detector Monitoring System, the AXIAL SHAPE INDEX shall remain within the limits of Figure 2.5-1.

During operation with the linear heat rate being monitored by the Incore Detector Monitor System, the alarm setpoints shall be adjusted to less than or equal to the limit when the following factors are appropriately included in the setting of the alarms:

1. A measurement-calculational uncertainty factor of 1.07,
2. An engineering uncertainty factor of 1.03,
3. A THERMAL POWER measurement uncertainty factor of 1.02, and
4. A penalty factor of 1.0025 to account for misaligned Incore Instruments.

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2.6 TOTAL UNRODDED INTEGRATED RADIAL PEAKING FACTOR -- F_r^T (Technical Specification 3/4.2.3)

The calculated value of F_r^T at RATED THERMAL POWER shall be:

≤ 1.690 whenever the reactor coolant flow rate is $\geq 360,000$ gpm.

≤ 1.664 whenever the reactor coolant flow rate is $< 360,000$ gpm and $\geq 354,600$ gpm.

≤ 1.639 whenever the reactor coolant flow rate is $< 354,600$ gpm and $\geq 349,200$ gpm.

2.6.1. The Power Dependent F_r^T limits, whenever the reactor coolant flow rate is $\geq 360,000$ gpm, are shown in Figure 2.6-1.

2.6.2. The Power Dependent F_r^T limits, whenever the reactor coolant flow rate is $< 360,00$ gpm and $\geq 354,600$ gpm, are shown in Figure 2.6-2.

2.6.3. The Power Dependent F_r^T limits, whenever the reactor coolant flow rate is $< 354,600$ gpm and $\geq 349,200$ gpm, are shown in Figure 2.6-3.

2.7 DNB Margin (Technical Specification 3/4.2.6)

The DNB margin shall be preserved by maintaining the cold leg temperature, pressurizer pressure, reactor coolant flow rate, and AXIAL SHAPE INDEX within the following limits:

Parameter	Limits
	<u>Four Reactor Coolant Pumps Operations</u>
a. Cold Leg Temperature	$\leq 549^\circ\text{F}$
b. Pressurizer Pressure	> 2225 psia*
c. Reactor Coolant Flow Rate	$\geq 360,000$ gpm with Linear Heat Rate and F_r^T limits as specified in Sections 2.5 and 2.6. or $\geq 354,600$ gpm with Linear Heat Rate and F_r^T limit reductions as specified in Sections 2.5 and 2.6. or $\geq 349,200$ gpm with Linear Heat Rate and F_r^T limit reductions as specified in Sections 2.5 and 2.6.
d. AXIAL SHAPE INDEX	FIGURE 2.7-1

* Limit not applicable during either the THERMAL POWER ramp increase in excess of 5% of RATED THERMAL POWER per minute or a THERMAL POWER step increase of greater than 10% of RATED THERMAL POWER.

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3. ANALYTICAL METHODS

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

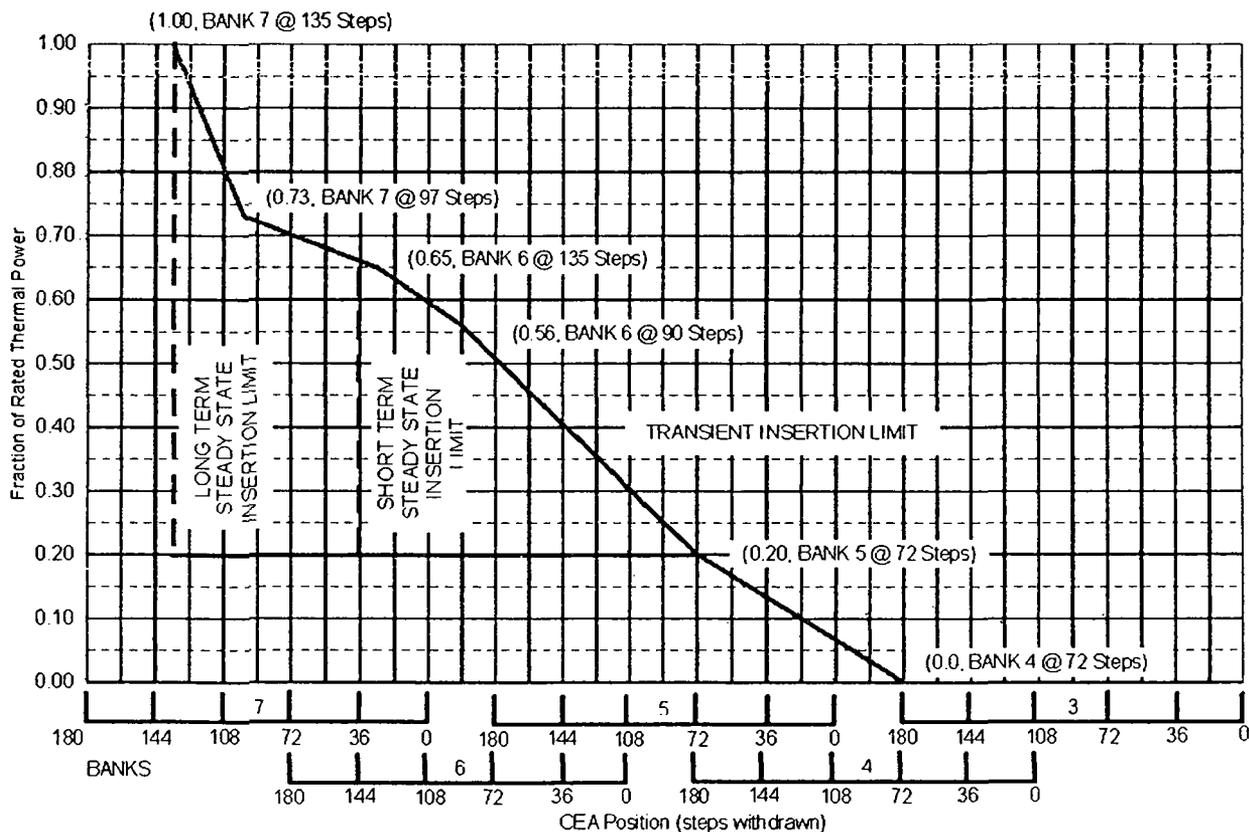
- 3.1 EMF-96-029(P)(A) Volumes 1 and 2, "Reactor Analysis System for PWRs Volume 1 - Methodology Description, Volume 2 - Benchmarking Results," Siemens Power Corporation, January 1997.
- 3.2 ANF-84-73 Revision 5 Appendix B(P)(A), "Advanced Nuclear Fuels Methodology for Pressurized Water Reactors: Analysis of Chapter 15 Events," Advanced Nuclear Fuels, July 1990.
- 3.3 XN-NF-82-21(P)(A) Revision 1, "Application of Exxon Nuclear Company PWR Thermal Margin Methodology to Mixed Core Configurations," Exxon Nuclear Company, September 1983.
- 3.4 XN-75-32(P)(A) Supplements 1 through 4, "Computational Procedure for Evaluating Fuel Rod Bowing," Exxon Nuclear Company, October 1983.
- 3.5 EMF-2328(P)(A), "PWR Small Break LOCA Evaluation Model S-RELAP5 Based," Framatome ANP, March 2001.
- 3.6 EMF-2087(P)(A), "SEM/PWR-98: ECCS Evaluation Model for PWR LBLOCA Applications," Siemens Power Corporation, June 1999.
- 3.7 XN-NF-78-44(NP)(A), "A Generic Analysis of the Control Rod Ejection Transient for Pressurized Water Reactors," Exxon Nuclear Company, October 1983.
- 3.8 XN-NF-621(P)(A) Revision 1, "Exxon Nuclear DNB Correlation for PWR Fuel Designs," Exxon Nuclear Company, September 1983.
- 3.9 XN-NF-82-06(P)(A) Revision 1 and Supplements 2, 4, and 5, "Qualification of Exxon Nuclear Fuel for Extended Burnup," Exxon Nuclear Company, October 1986.
- 3.10 ANF-88-133(P)(A) and Supplement 1, "Qualification of Advanced Nuclear Fuels PWR Design Methodology for Rod Burnups of 62 GWd/MTU," Advanced Nuclear Fuels Corporation, December 1991.

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- 3.11 XN-NF-85-92(P)(A) "Exxon Nuclear Uranium Dioxide/Gadolinia Irradiation Examination and Thermal Conductivity Results," Exxon Nuclear Company, November 1986.
- 3.12 ANF-89-151(P)(A), "ANF-RELAP Methodology for Pressurized Water Reactors: Analysis of Non-LOCA Chapter 15 Events," Advanced Nuclear Fuels Corporation, May 1992.
- 3.13 EMF-1961(P)(A) Revision 0, "Statistical Setpoint/Transient Methodology for Combustion Engineering Type Reactors," Siemens Power Corporation, July 2000.
- 3.14 EMF-2310(P)(A), Revision 1, "SRP Chapter 15 Non-LOCA Methodology for Pressurized Water Reactors," Framatome ANP, May 2004.
- 3.15 EMF-92-153(P)(A), Revision 1, "HTP: Departure from Nucleate Boiling Correlation for High Thermal Performance Fuel," Siemens Power Corporation, January 2005.
- 3.16 EMF-92-116(P)(A) Revision 0, "Generic Mechanical Design Criteria for PWR Fuel Designs," Siemens Power Corporation, February 1999.

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Note: Regulating CEAs that are ≥ 176 steps withdrawn are considered fully withdrawn and are acceptable per this figure.

Figure 2.4-1
CEA Insertion Limit vs. THERMAL POWER With
Four Reactor Coolant Pumps Operating

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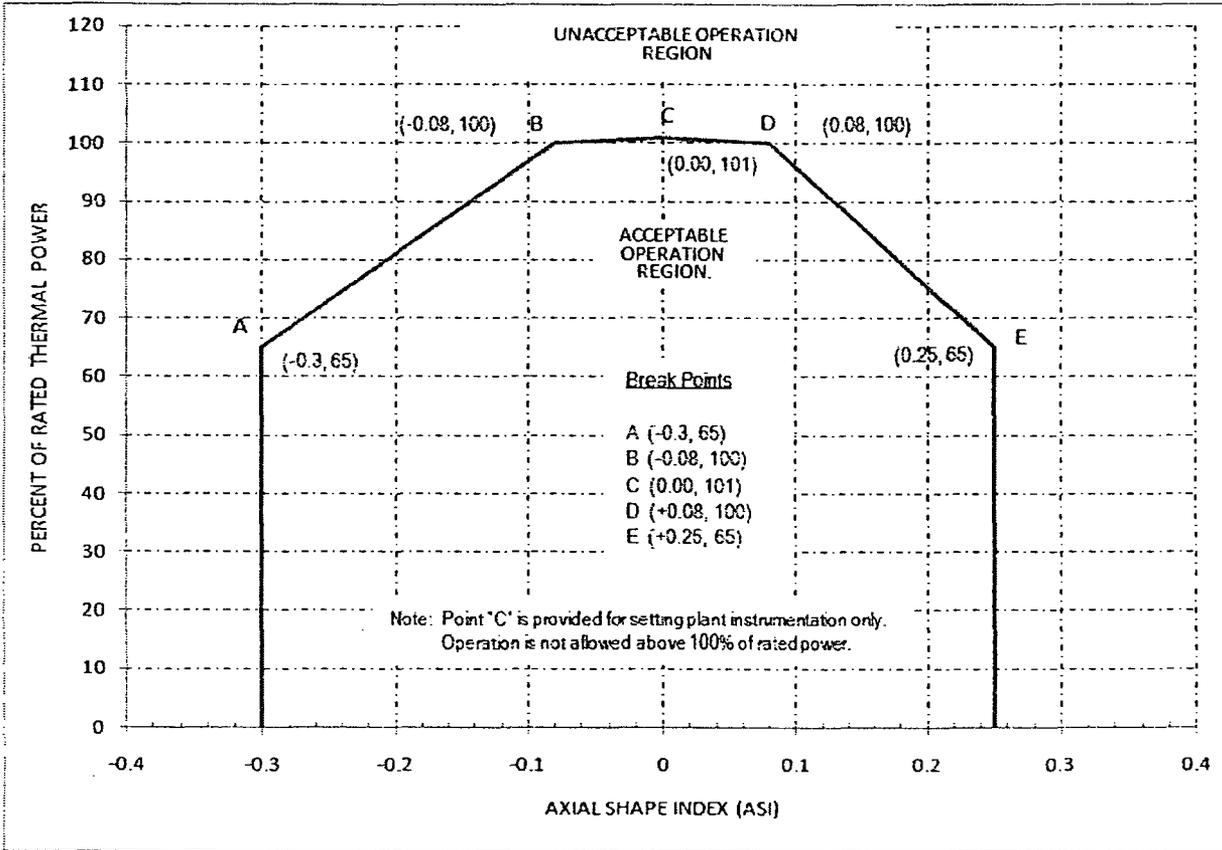
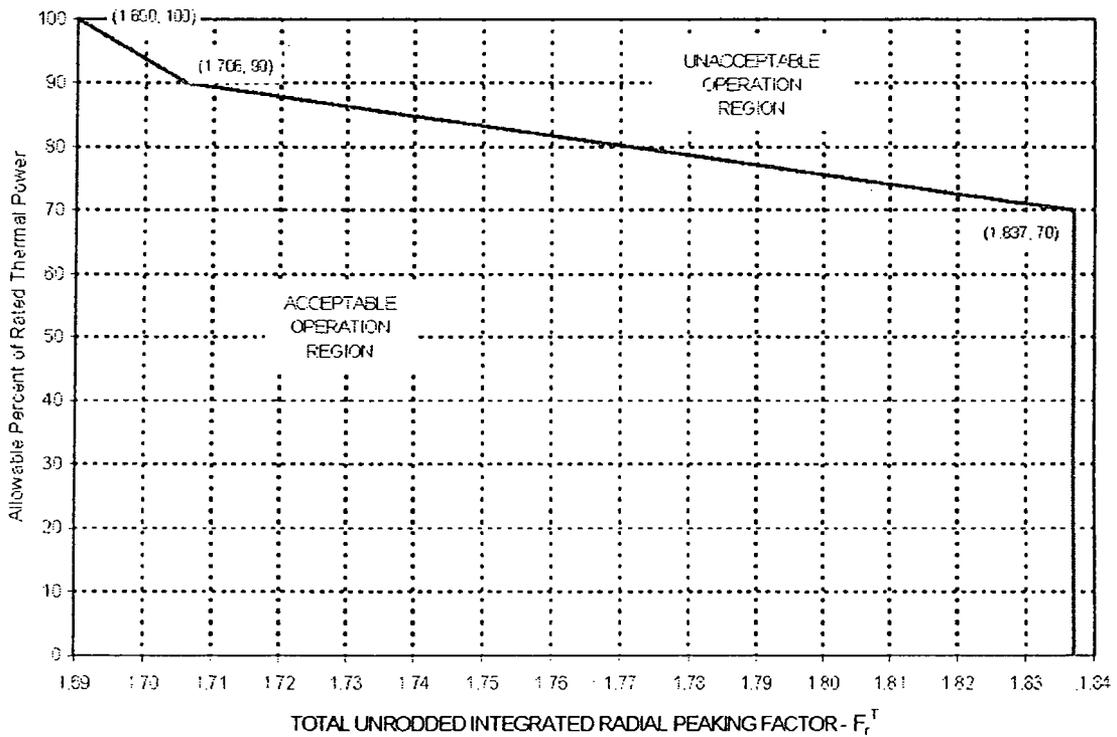


Figure 2.5-1
AXIAL SHAPE INDEX vs.
PERCENT OF ALLOWABLE POWER LEVEL

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Note: The F_r^T limit should be reduced for reactor coolant flow rates $\geq 349,200$ gpm and $< 360,000$ gpm (see Section 2.6).

Figure 2.6-1
TOTAL UNRODDED INTEGRATED RADIAL PEAKING FACTOR
vs. Allowable RATED THERMAL POWER
For Reactor Coolant Flow Rates $\geq 360,000$ gpm

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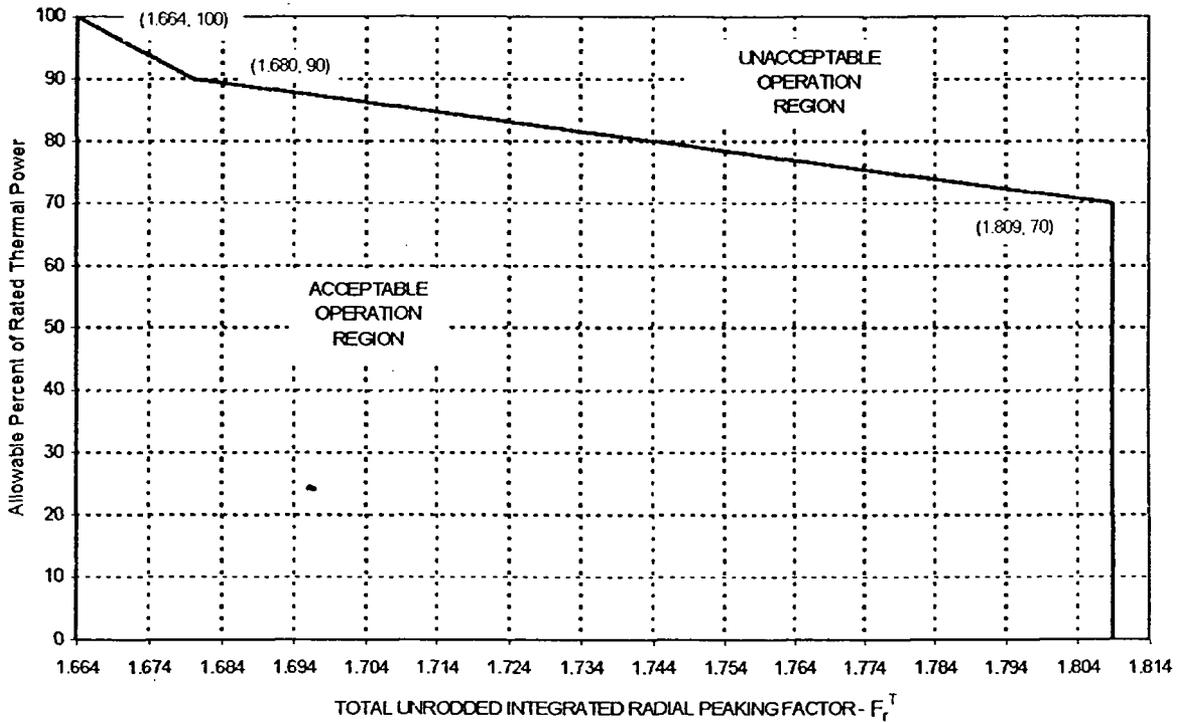


Figure 2.6-2
TOTAL UNRODDED INTEGRATED RADIAL PEAKING FACTOR
vs. Allowable RATED THERMAL POWER
For Reactor Coolant Flow Rates < 360,000 gpm and \geq 354,600 gpm

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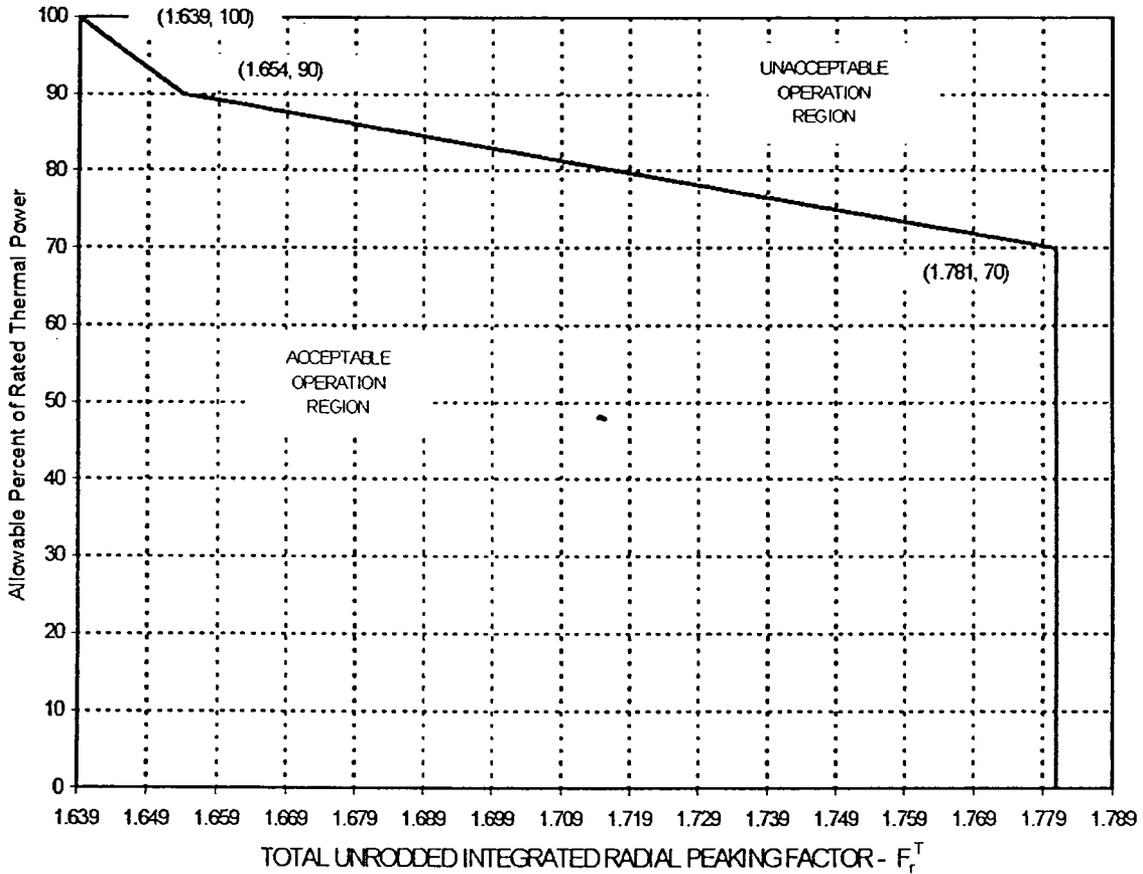


Figure 2.6-3
TOTAL UNRODDED INTEGRATED RADIAL PEAKING FACTOR
vs. Allowable RATED THERMAL POWER
For Reactor Coolant Flow Rates < 354,600 gpm and \geq 349,200 gpm

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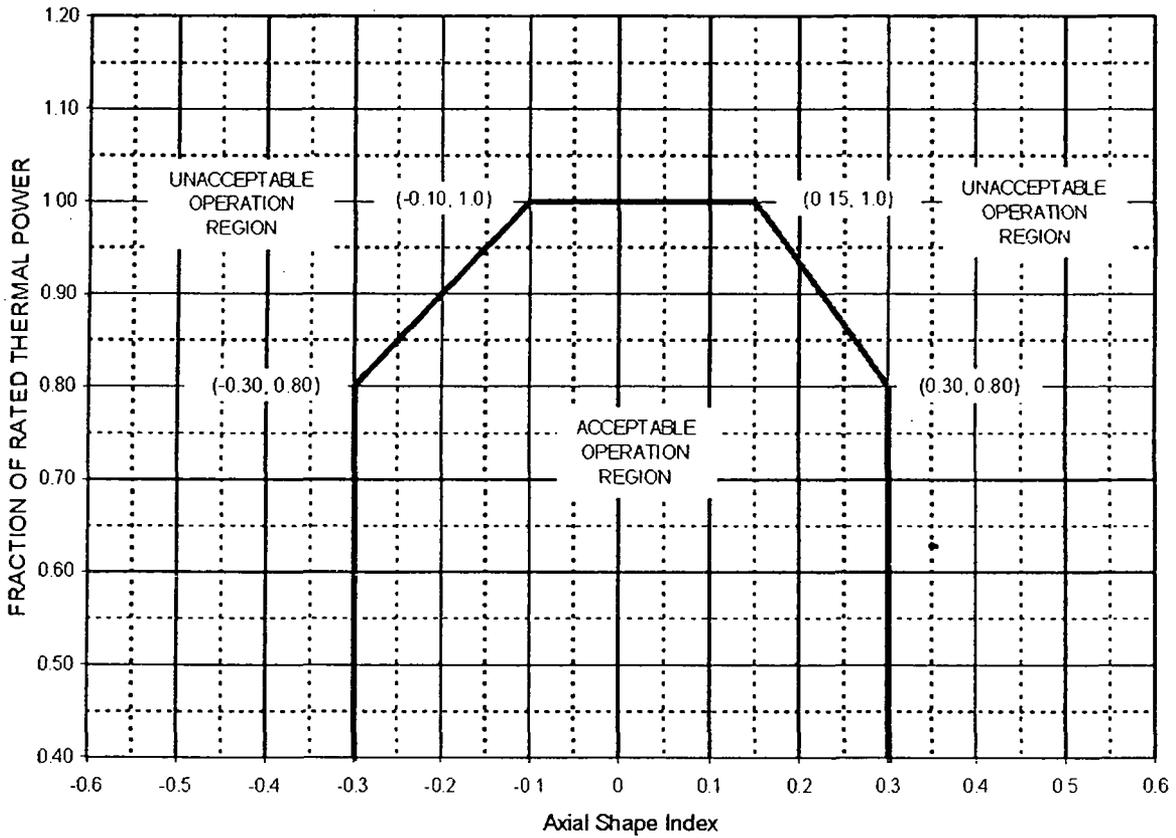


Figure 2.7-1
AXIAL SHAPE INDEX Operating Limits With
Four Reactor Coolant Pumps Operating